

Remarks

The applicants thank the Examiner for the thorough examination of the application. No new matter is believed to be added to the application by this amendment.

Status of the Claims

Claims 1, 3, 5-13 and 15-23 are pending in the application. Claims 2 and 14 are cancelled by this amendment. The amendments to claims 1 and 13 incorporate the subject matter of canceled claims 2 and 14, respectively, and find additional support in paragraph 0033 at page 9 of the specification.

Statement Of Substance Of Interview

The Examiner is thanked for graciously conducting a personal interview with the applicants' representative on November 23, 2004. During the interview, the temperature and process of forming the inventive pixel was discussed in light of the cited art. By the end of the interview, an agreement had not been reached.

At the end of the interview, the Examiner prepared an Interview Summary. The Interview Summary has been reviewed, and it appears to accurately reflect the substance of the interview.

Rejections under 35 U.S.C. § 103(a) based on Lyu

Claims 1, 4-13 and 15-18 and 20-21 are rejected under 35 U.S.C. § 103(a) as being obvious over the Lyu (U.S. Patent 6,001,539) in view of Tran (U.S. Patent 5,135,581), Carter (U.S. Patent 5,628, 933) and Suzuki (U.S. Patent 6,466,293). The Examiner adds the teachings of Kaneko (U.S. Patent 6,433,842) to the aforesaid rejection to reject claims 2, 3 and 14. The Examiner adds the teachings of Kaiju (U.S. Patent 5,972,527) to the first mentioned rejection to reject claims 5 and 19. Applicants respectfully traverse.

The Present Invention And Its Advantages

The present invention pertains to a process for forming a pixel electrode in a liquid crystal display where the pixel electrode has an amorphous structure. This amorphous structure is attained by utilizing hydrogen-containing gas in a novel temperature control environment.

The invention finds a typical embodiment in instant claim 1:

1. A method of fabricating a pixel electrode in a liquid crystal display including a switching device for driving the pixel electrode, the method comprising:

depositing a protective film over a substrate to cover the switching device;

defining a contact hole in the protective film to expose one electrode of the switching device; and

forming the pixel electrode connected, via the contact hole, to said one exposed electrode, wherein the pixel electrode is formed by placing the substrate in a vacuum chamber and injecting hydrogen-containing gas at a temperature of less than about 400 °C, wherein the substrate has a temperature of less than about 200 °C when forming the pixel electrode, and the pixel electrode has an amorphous structure.

One of the many novel features of the invention resides in when forming the pixel electrode, the temperature of the substrate corresponds to half a set temperature of the vacuum chamber (see claims 22 and 23).

Distinctions Of The Invention Over The Cited Art

Lyu discloses many conventional steps for forming a liquid crystal display, including forming a substrate, forming a TFT structure, depositing a passivation layer, forming a contact hole and forming a pixel electrode. Lyu fails to disclose forming an amorphous pixel electrode. Lyu additionally fails to disclose the temperature conditions of forming the pixel electrode. The Examiner admits to the failings of Lyu at page 3, lines 3-6 of the Office Action: "Lyn does not explicitly disclose that the pixel electrode is formed by placing the substrate in a vacuum chamber and injecting hydrogen-containing gas at a temperature of less than 400 °C, and the substrate has a temperature of less than about 200 °C when forming the pixel electrode."

The Examiner then turns to Tran to address the deficiencies of Lyu. Tran discloses the use of a hydrogen-containing gas at column 2, lines 27-34 and at column 3, line 38. However, this gas is used to modify the crystal lattice structure of the oxide composition such as is noted at column 3 lines 46-50 and 59-67 of Tran. In contrast, the present invention set forth in independent claims 1 and 13 pertain to an amorphous pixel structure. As a result, the Examiner is changing the principal of operation of Tran. If the proposed modification or combination of the prior art would change the

principle of operation of the prior art invention being modified, then the teachings of the reference are not sufficient to render the claims *prima facie* obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Further, Tran discloses:

When the precursor is a metal, the use of O₂ is required. The O₂ reacts with the metal to form light transmissive, electrically conductive oxides of the present invention. On the other hand, when the precursor is a metal oxide, the use of O₂ is not required. Still, the use of O₂ is preferred even when the precursor is a metal oxide in that metal oxide films have better light transmissive and electrical conductivity characteristics when formed in the presence of O₂. Tran at column 4, line 66 to column 5, line 8.

Tran thus fails to teach or suggest using a hydrogen-containing gas instead of O₂. Tran accordingly teaches away from the invention. It is improper to combine references where the references teach away from their combination. In re Grasselli, 713 F.2d 731, 218 USPQ 769, 779 (Fed. Cir. 1983)

The Examiner also turns to Tran at column 4, lines 23-32 for teachings pertaining to various sputtering temperatures between 20 °C and 300 °C.

Tran fails to teach anything about the temperature of the substrate. Tran additionally fails to teach anything about the temperature differential of the substrate. Tran further fails to teach or suggest that the substrate is about half of the 400 °C set point of the vacuum chamber.

The Examiner also turns to Carter, noting that Carter allows a substrate to cool to room temperature (which is less than 200 °C), and asserts that this

covers the substrate temperature of the invention. However, Carter fails to disclose or suggest the claim relationship between the substrate temperature and the temperature of the injected hydrogen-containing gas (see claims 1 and 13). Carter also fails to disclose or suggest the temperature of the substrate being half the set point (see claims 22 and 23).

Suzuki pertains to a process for injecting liquid crystal into a liquid crystal panel formed by joining the upper and lower substrates. Suzuki fails to teach or suggest forming a pixel electrode within a vacuum chamber. As a result, Suzuki fails to address the deficiencies of Lyu, Tran and Carter.

As a result, the combination of Lyu, Tran, Carter and Suzuki would fail to motivate one having ordinary skill in the art to produce the invention having an amorphous pixel of claims 1 and 13. A *prima facie* case of obviousness has thus not been made. Claims depending upon claims 1 and 13 are patentable for at least the above reasons.

The Examiner also turns to Kaneko at column 5, lines 47-51 for teachings pertaining to the utilization of amorphous ITO or IZO which allows for use of a weak-acid etchant. Kaneko at column 9, lines 28-43 discussed advantages of using a weak-acid etchant. However, Kaneko fails to address the inability of Lyu, Tran, Carter and Suzuki (if they could be combined) to suggest the temperature differential between the substrate and the set point of the temperature of the vacuum deposition. A *prima facie* case of obviousness has thus not been made over Lyu, Tran, Carter, Suzuki and Kaneko.

The Examiner also uses Kaijou to reject the 50-150°C embodied in claims 5 and 19 of the invention. Kaijou column 11, lines 53-57 states: "When a polymer substrate is used as a substrate, the substrate temperature is preferably between room temperature and 200°C. When a glass substrate is used, it is preferably between room temperature and 400°C." The Examiner infers this teaches the 50-150°C substrate temperature range.

In contrast, paragraph 0033 at pages 9 to 10 of the specification discusses sputtering at 400°C with a substrate temperature less than 200°C "corresponding to half the set temperature." Paragraph 0033 additionally sets forth the preferred embodiment of the substrate temperature being between 50°C and 100°C. However, nowhere in the applied prior art is this type of relationship between the sputtering temperature and the substrate temperature (half the set temperature) found.

That is, However, Kaiju fails to address the inability of Lyu, Tran, Carter and Suzuki (if they could be combined) to suggest the temperature differential between the substrate and the injected hydrogen-containing gas, or the relationship between the set point and the substrate. A *prima facie* case of obviousness has thus not been made over Lyu, Tran, Carter, Suzuki and Kaiju.

Additionally, the Examiner is now using up to five references in making rejections, which infers impermissible hindsight reconstruction.

As has been shown, the combination of Lyu, Tran, Carter and Suzuki would fail to motivate one having ordinary skill in the art to produce the

invention having an amorphous pixel of claims 1 and 13. Kaneko or Kaiju each fails to address these deficiencies. A *prima facie* case of obviousness has thus not been made. Claims depending upon claims 1 and 13 are patentable for at least the above reasons.

These rejections are overcome and withdrawal thereof is respectfully requested.

Prior art made of record and not utilized by the Examiner

The prior art made of record in the application and not utilized by the Examiner shows the status of the conventional art which the invention supercedes. Accordingly, no further remarks are necessary.

Conclusion

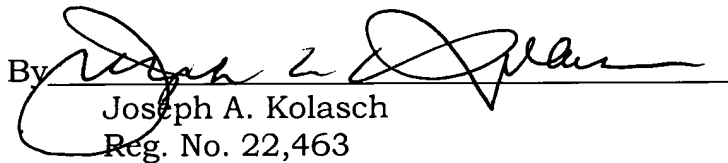
Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No.42,593) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicant(s) respectfully petition(s) for a two (2) month extension of time for filing a reply in connection with the present application, and the required fee of \$450.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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